

Problems in Efficient Development of Clean Energy in Xizang

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ABSTRACT

As Xizang's economic development enters the new normal stage, the extensive and highly polluting production mode in the past no longer meets the needs of high-quality economic development in Xizang. Therefore, there is an urgent need to reduce the consumption of traditional fossil energy, develop low-carbon and clean green energy, optimize the energy structure, and promote green and sustainable economic development.

KEYWORDS

Xizang; Clean Energy; Existing Problems.

1. INTRODUCTION

With the rapid development of our country's economy and the continuous deepening of industrialization, the contradiction between energy demand and environmental protection, which restricts sustainable economic and social development, has become increasingly prominent. Since entering the industrial era in the 19th century, oil and natural gas! Coal and other fossil conventional energy sources have become the energy pillars of economic and social development. With the rapid development of the economy and society, the consumption of conventional energy has increased sharply, leading to a sharp decline in the reserves of traditional energy and making it difficult to meet the energy needs of rapid economic and social development; At the same time, with the increasing consumption of fossil fuels, the pressure on ecological environment protection is also increasing, forcing countries around the world to focus on the development and utilization of clean energy[1]. As the world's largest economic development body, China's future energy consumption will face dual pressures from both internal and external sources. Therefore, the rapid, safe, and efficient development and utilization of clean energy will also be an important strategic support for China's economic development[2]. The 14th Five Year Plan for China's development also clarifies the direction and focus of future energy development, which is to promote low-carbon and circular development. Therefore, it is necessary to promote the energy revolution, accelerate energy technology innovation, build a clean, low-carbon, safe and efficient modern energy system; increase the proportion of non fossil energy, promote the clean and efficient use of fossil energy such as coal; accelerate the development of wind energy, solar energy, biomass energy, hydropower, geothermal energy, and safe and efficient development of nuclear power; strengthen energy storage and smart grid construction, develop distributed energy, and promote energy-saving and low-carbon power dispatch.

Based on the 8th "Sunshine Forum" held in Xizang, this paper comprehensively interprets and discusses Xizang's "double carbon" strategic opportunities and the professional field of comprehensive utilization of renewable energy, and puts forward the existing problems according to the current situation of clean energy development and utilization in Xizang, so as to promote the development of clean energy science and technology innovation in Tibet.

2. CURRENT SITUATION OF CLEAN ENERGY UTILIZATION IN XIZANG

In recent years, Xizang has continued to promote the construction of clean energy projects, and the construction of clean energy industries focusing on water, wind and light has made great progress. Zhengyuan continues to inject vigorous impetus into high-quality development.

2.1. Power Generation Installation Structure

As of the end of 2022, the total installed capacity of electricity in China was approximately 2.564 billion kilowatts, of which hydropower, thermal power, nuclear power, wind power, and solar power were approximately 414 million kilowatts, 1.332 billion kilowatts, 56 million kilowatts, 365 million kilowatts, and 393 million kilowatts, respectively. The proportion of clean energy installed capacity reached 48.04%[1]. By the end of 2022, Xizang's total installed power capacity will be about 6.56 million kilowatts, including 4.15 million kilowatts, 440000 kilowatts, 30000 kilowatts, 1.89 million kilowatts and 43200 kilowatts for hydropower, thermal power, wind power, solar energy and geothermal power, respectively. The installed clean energy capacity will account for 93.3%, ranking first in all provinces and regions in China[3].

2.2. Power Generation Structure

As of the end of 2022, the total power generation in China was approximately 8.69 trillion kilowatt hours, of which hydropower, thermal power, nuclear power, wind power, and solar power were approximately 1.36 trillion kilowatt hours, 5.73 trillion kilowatt hours, 0.42 trillion kilowatt hours, 0.76 trillion kilowatt hours, and 0.43 trillion kilowatt hours, respectively. The proportion of clean energy generation reached 34.09%[3]. By the end of 2022, Xizang's total power generation will be about 14.6 billion kilowatt hours, of which hydropower, thermal power, wind power and solar power will be about 12.5 billion kilowatt hours, 100 million kilowatt hours, 100 million kilowatt hours and 1.9 billion kilowatt hours, respectively. Clean energy power generation will account for 99.32%[3].

Xizang is rich in clean energy resources. According to the results of the latest round of resource census, the total amount of technically exploitable energy exceeds 1 billion kilowatts. However, the target development rate is less than 1%, and the development potential is huge. By the end of 2022, Xizang's total social electricity consumption is 12 billion kWh, with the maximum load of 2.0039 million kW, with growth rates of about 17.4% and 4.9% respectively. According to peak estimation, the peak value of the maximum load and power consumption in Xizang in the future is only about 20 million kilowatts and 100 billion kilowatt hours. The exploitable scale of Xizang's "hydropower+pumped storage" exceeds 300 million kilowatts[3]. The clean energy resources reserve is far greater than its own energy and power needs, and it has the advantage of long-term sustainable power transmission.

3. MAJOR PROBLEMS

3.1. Good Resource Endowment with Few External Delivery Channels

Xizang is rich in clean energy resources, but the overall scale of the market is small. Large scale development of Xizang's clean energy urgently needs markets outside the region to solve the problem of absorption. Tang Xisheng, a researcher at the Institute of Electrical Engineering of the Chinese Academy of Sciences and doctoral supervisor, pointed out that "Xizang is rich in clean energy, but its absorptive capacity is really limited, and the market outside the region is now relatively saturated". If Xizang's clean energy consumption wants to maintain a rapid growth, it needs to meet the basic balance between supply and demand. However, Xizang's power grid has been operating in isolation for a long time in its history. In recent years, the Qinghai Tibet interconnection project, the Sichuan

Tibet interconnection project and other power routes have been built successively, and the connection with external power grids has been greatly strengthened. However, the affordability of the main network is still weak. Wang Yunbo, member of the Party Leadership Group and deputy director of the Xizang Energy Administration, said, "At present, the main grid structure has risen to the long chain grid structure of 500 kV double circuit lines, but some areas are still weak, especially the county grid structure is still weak, and the power supply structure is limited." Si Pengfei, senior engineer of CSCEC Southwest Design and Research Institute, said, "Xizang is located in a plateau area, with relatively low air density, and there is also a lack of oxygen, which also makes it difficult to build the power grid in Xizang. In addition, the power grid structure in Xizang is not as strong as in the eastern region, and there are still some difficulties in grid connected renewable energy generation and transmission. From the current situation, the most appropriate transmission mode of output is still UHV transmission lines." As the domestic energy storage industry ushers in the year of outbreak, the wind and solar energy distribution and storage can not only achieve peak shaving and valley filling, power compensation and other functions, but also help clean energy smooth output, friendly grid connection, and achieve stable and sustainable external transmission. Experts at the meeting believed that wind and solar energy distribution and storage may be a powerful tool to solve the problem of wind and light abandonment, and large-scale energy storage is expected to play an important role in the future development of green power in Xizang.

3.2. Poor Security and Stability, Difficult Grid Connection

According to the national new energy grid connection consumption in February 2023 released by the official WeChat of the National New Energy Consumption Monitoring and Early Warning Center, in February Xizang, the light rejection rate was 26.9%, the photovoltaic utilization rate was only 73.1%, and in January February it was 72.3%[4]. Although the problem of light abandonment and power limitation has been alleviated, it has not been completely solved. He Yaling, an alternate member of the 19th and 20th Central Committee of the Communist Party of China and an academician of the CAS Member, pointed out that "under the vision of carbon neutrality, the energy field will usher in a huge revolution, and new energy will replace traditional fossil energy and become the pillar of the energy field." However, this has led to the reduction of the scale of new photovoltaic power stations approved for construction in Xizang, increasing the difficulty of grid connection, and the high rejection rate of light is a "fatal" factor. Due to the long transmission distance and the need for improved transmission infrastructure, the current transmission cost is still high, and wind and solar power generation relies heavily on natural conditions and has obvious instability. If the input power to the power grid fluctuates, it will also have a serious impact on the safe operation of the power grid. Therefore, to ensure the safe and stable operation of the power grid, the proportion of grid connection allocated to wind and photovoltaic power is limited. In view of the volatility and intermittency of new energy represented by wind power and photovoltaic, Xu Honghua, director of the Special Committee for Integrated Systems of the Chinese Renewable Energy Society and researcher of the Institute of Electrical Engineering of the Chinese Academy of Sciences, said, "For the weak power grid, the high proportion of new energy power generation on the grid will not only bring power and electricity balance problems, but also bring security and stability problems to the power system." Most photovoltaic power stations are located in rural power grid areas with relatively weak grid structure and are relatively concentrated. For example, in Shannan, Xizang, the large-scale and centralized grid connection of photovoltaic power stations, coupled with the weak connection between Shannan power grid and the Central Tibet power grid, has a great impact on the power grid flow, reactive voltage and stability control. The superposition of various risk factors affecting the grid security has complicated and severe grid security situation.

3.3. Small Industrial Scale and Poor Infrastructure

Xizang has made certain achievements in the application, research, demonstration and promotion of solar energy, wind energy, hydropower and geothermal energy, but the overall level of development and utilization is low. The development and construction scale of hydropower stations in the entire region is relatively small, and hydropower resources are not effectively utilized; Clean energy sources such as solar and wind energy are still in their early stages of complementary and diversified development and utilization, with relatively weak technological capabilities, high utilization costs, and imperfect operational management mechanisms; The development and utilization of geothermal resources are also lagging behind due to the lack of comprehensive planning. Wang Jianguo, director and senior engineer of the the Pearl River River Water Conservancy Research Institute of the the Pearl River River Water Conservancy Commission, said: "Xizang's clean energy industry started late, its core technology lacked support, investment and financing were restricted, and its infrastructure was poor. In addition, the development and utilization of clean energy was high-risk, so small and medium-sized enterprises were difficult to cope with risks, which restricted the development and utilization of clean energy resources, and was not conducive to the formation of an effective clean energy industry chain. Therefore, the existing industry was small." At present, Xizang's development is in a transition period from high-speed growth to medium and high-speed growth, and the driving force of growth is shifting from investment driven to investment driven and industrial development driven. Industrial construction is faced with the heavy task of expanding scale and improving quality. Cui Tonghuan, deputy director of Huaneng Xizang the Yarlung Zangbo River Hydropower Development and Investment Co., Ltd., said: "Compared with other regions in China, the construction of photovoltaic power stations in Xizang is faced with the double problems of high costs and difficulties in accessing the grid." Although Xizang is rich in sunshine resources, most enterprises are still reluctant to choose this place as the main power station construction site because of the weak demand for power by local residents, the difficulty in building photovoltaic power stations, poor clean energy infrastructure, and difficulties in accessing the grid.

3.4. Multiple Technical Bottlenecks and Limited High-end Talents

Under extreme operating conditions such as low pressure, strong ultraviolet, extreme low temperature, large temperature difference, and low air density in Xizang, relevant equipment and products are facing severe challenges and tests in terms of high weather resistance, which are mainly reflected in the following aspects:

- (a) The key technologies for efficient development and utilization of clean energy and the weak adaptability of products to plateau. There are still deficiencies in the research and experimental testing of design criteria, measures, processes, technologies, equipment, materials, etc. for high-altitude photovoltaic microgrid power stations and photothermal systems, and a system of clean energy related technical standards and engineering technical guidelines has not yet been formed under specific climate conditions of high altitude and high cold.
- (b) Lack of intelligent operation and maintenance of clean energy equipment. Due to issues such as steep terrain, heavy snow in winter, and traffic disruptions, there is a lack of timely and effective operation and maintenance for existing development and utilization projects, resulting in their operating status changing from "minor problems" to "major failures", ultimately leading to continuous weakening or even complete loss of equipment functions.
- (c) Reduced energy storage capacity and short lifespan. The addition of a grid type energy storage system has not yet been fully formed, and the severe winter cold and high-altitude special climate and geographical environment have seriously affected the stability and reliability of clean energy power station power supply. The battery capacity and service life have also sharply decreased due to factors such as high and low temperatures.

(d) The comprehensive utilization method of clean energy is single, and the technology utilization is single. The comprehensive utilization of clean energy in Xizang mainly focuses on power supply and heating. There is less basic research on diversified utilization such as oxygen and hydrogen production, less approval of experimental projects, lack of top-level design, and formulation, revision and improvement of relevant standards.

(e) There is a relative shortage of high-end talents. Xizang has obvious deficiencies in the introduction of professional talents in the field of clean energy and the training of local talents. It is relatively deficient in basic research, talent gathering, achievement transformation and other aspects of clean energy, which leads to a lack of innovation ability. The development of clean energy industry has become a weak link, and most of them rely on regional surgical research assistance.

Tan Tianwei, an academican of the CAE Member, pointed out: "The realization of the dual carbon goal requires accelerating technological innovation in the field of new energy, and scientific research institutions and colleges should be at the forefront of technological innovation." At the same time, Zhou Peng, vice president of the Hydraulic and Environmental Exploration Institute of the Geothermal Geology Brigade of the Xizang Geological Survey Bureau, on behalf of Duoji, an academican of the CAE Member, pointed out in the report: "On the one hand, we should actively introduce professional and technical personnel from the mainland to create a good working and living environment for them; on the other hand, we should attach importance to the training of local professional and technical personnel and management personnel." To achieve the dual carbon goal, Xizang must rely on science and technology to solve key technical bottlenecks, vigorously cultivate local talents, and increase scientific and technological innovation and technology combination.

4. OPINIONS AND SUGGESTIONS

(a) Clear policy support. Firstly, priority should be given to ensuring the land, transportation, funding, power supply and other elements required for clean energy industry projects, and providing comprehensive services throughout the entire process of project approval, construction, and production to ensure the smooth implementation of the project; The second is to maintain the basic income of clean energy power generation through long-term contracts, price difference contracts, etc., and ensure the market financing ability of new energy projects.

(b) Clarify funding subsidies. One is to actively seek policy and financial subsidies to address issues such as immature equipment technology, high initial investment costs, and high risks in development, to help enterprises overcome difficulties, ensure that enterprises participating in clean energy research and production are profitable, and encourage them to actively invest in the clean energy industry, creating a favorable external environment for development[5]; Secondly, it is recommended to accelerate the research and improvement of cross provincial market trading mechanisms that adapt to a high proportion of clean energy, orderly promote the integration of clean energy in the autonomous region into the national unified market, and establish a market mechanism that matches the clean energy export base. Third, due to the characteristics of hydropower and new energy power generation in Xizang, a number of guaranteed power sources such as gas turbines have been built. However, in order to provide space for the consumption of clean energy in the region, the annual use time of guaranteed power sources is very short, which leads to the cost of relevant power sources playing a major role and difficult to survive. It is recommended to improve the cost dredging mechanism of relevant guaranteed power sources, such as establishing a capacity pricing mechanism, to ensure the safety of relevant power sources and the survival of the power station.

(c) Clearly define the responsible party. Firstly, the development scale and pricing policies of the clean energy industry should be strengthened, with government guidance and market leadership, and a mechanism for connecting interests that benefit both enterprises and the public should be established to promote high-quality development of the clean energy industry and further enhance the scientificity

of planning and layout in the process of clean energy development[6]; The second is to optimize and improve the dual control system for energy consumption, and stimulate various flexible regulatory entities to exert their regulatory capabilities through mechanisms such as capacity markets and auxiliary service markets.

(d) Establish a rolling adjustment mechanism for planning. Firstly, energy regulatory authorities in various regions (cities) can timely propose adjustment suggestions to the energy regulatory authorities in the autonomous region. The energy regulatory authorities in the autonomous region will work together with other regions (cities) to comprehensively consider integrated base planning, regional terrain and geological construction conditions, and environmental protection requirements, and continuously carry out planning adjustment work; The second is to include projects that meet the depth requirements of the planning stage but may involve environmental constraints such as ecological protection red lines in the reserve project library. These projects can be rolled and adjusted into the key implementation project library after implementing relevant conditions, avoiding and connecting with environmental constraints such as ecological protection red lines.

(e) Establish a diversified grid connection mechanism. One is that guaranteed grid connection projects are domestic demand photovoltaic projects that mainly serve the security of energy supply in the service area. Grid enterprises should implement guaranteed grid connection, achieve synchronous construction and operation of supporting power transmission projects and photovoltaic power station projects, and ensure that the projects can "merge and develop as much as possible" after meeting the corresponding grid connection conditions, without adding additional unreasonable conditions; The second is that market-oriented grid connection projects are photovoltaic projects that are beyond the scope of guaranteed grid connection and still have the willingness to connect to the grid. After implementing grid connection conditions through market-oriented methods such as self construction, joint construction and sharing, or purchasing services, they can be connected to the grid by the power grid enterprise. The grid connection conditions mainly include the construction of newly added pumped storage, thermal storage solar thermal power stations, new energy storage, and adjustable loads.

(f) Establish a mechanism for sharing benefits in resource development. One is to improve the market mechanism that adapts to a high proportion of clean energy, and orderly promote the participation of clean energy in electricity market transactions; The second is to establish a medium - and long-term electricity trading mechanism that is suitable for the characteristics of new energy, and guide clean energy to sign longer term medium - and long-term contracts; Thirdly, encourage the participation of clean energy quotation in the spot market, and do not include the assessment of wind and solar power curtailment for electricity that has not been awarded in the quotation; The fourth is to promote peak shaving services in the spot market, and explore the introduction of new auxiliary services such as climbing in areas with a high proportion of clean energy.

5. CONCLUSION

With the development of Xizang's economy, energy and environmental problems have aroused widespread concern of human society. On the one hand, vigorously strengthening the development and utilization of clean energy will have a good effect on improving the global environment and also promote the development of the global economy towards a green and low-carbon direction; On the other hand, the development and utilization of clean energy are also conducive to the development of new energy, such as the promotion and use of new energy vehicles. In the long run, paying attention to environmental issues, climate change, and exploring the development and utilization of clean energy have become world trends and trends. Therefore, optimizing the energy consumption structure, exploring the path of green and low-carbon development and utilization of clean energy, and promoting the sustainable, rapid and healthy development of Xizang's economy and society have become the top priority of current theoretical and practical work.

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